Subfascial endoscopic perforating vein surgery as treatment for lateral perforating vein incompetence and venous ulceration

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Introduction: **Endoscopic ligation of perforating veins (subfascial endoscopic perforating vein surgery [SEPS]) is valuable in treatment of venous ulcer on the medial aspect of the lower leg. Venous ulcerations on the lateral aspect of the lower leg are less common, but are of equal clinical importance.**

Material and methods: **Over 4 years we performed SEPS on the lateral aspect of the lower leg in 13 patients. Preoperative and postoperative duplex scanning of the perforating veins was performed in all patients.**

Results: **Mean follow-up was 53 months (range, 33-81 months). Complete healing of venous ulcer was achieved in six patients within 6 months. Ulceration persisted in six patients, and ulcer recurred in three patients after 17, 29, and 60 months, respectively. Postoperative duplex scans showed persistent insufficient perforating veins in about 25% of patients.**

Conclusion: **There is a considerable difference between the results of SEPS on the medial side of the lower leg and the same procedure on the lateral side. SEPS on the lateral side of the lower leg, as performed in this small series, does not contribute to ulcer healing or recurrence. A considerable number of perforating veins are missed at surgery, resulting in persistent insufficient perforating veins postoperatively. The poor results of this study emphasize the need for adequate anatomic information to improve the surgical outcome. (J Vasc Surg 2003;38:799-803.)**

Endoscopic ligation of perforating veins, or subfascial endoscopic perforating vein surgery (SEPS), is valuable in treatment of venous ulcer on the medial aspect of the lower leg.[1] The procedure can be performed quickly, with fewer complications and better results than with subcutaneous or subfascial open surgical exploration.[1-4] However, SEPS has only been used as treatment of perforating vein insufficiency on the medial aspect of the lower leg.[2-4] Perforating vein insufficiency can lead to varicosity, various skin changes, and ulceration. Although venous ulcers tend to develop mainly in the internal perimalleolar area, most commonly over the medial malleolus, comparable venous ulcers over the lateral malleolar area can occur (10% overall), with the same clinical consequences. These ulcers are notoriously slow to heal, and generally recur if the underlying cause of venous hypertension is not removed. Therefore the primary goal should be to relieve high venous pressure in the skin, with ligation of the insufficient perforating veins at subfascial endoscopy. An important factor contributing to the success rate of SEPS is anatomic knowledge concerning the exact location of the perforating veins.[5] A considerable number of studies have been performed on the medial aspect of the lower leg; however, no anatomic information is available regarding the lateral aspect of the lower leg. Our aim was to evaluate the value of lateral SEPS in patients with venous ulcerations on the lateral side of the lower leg.

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Competition of interest: none.

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Published online . . .

0741-5214/2003/$30.00 + 0
doi:10.1016/S0741-5214(03)00430-0

PATIENTS AND METHODS

Over 4 years, venous ulceration was treated in 13 consecutive patients, 4 men and 9 women, with average age 68 years (range, 36-79 years). Results were analyzed retrospectively. The indication for SEPS was lateral venous ulceration, C_6 according to the CEAP classification, in 12 patients, and varicosities, C_2 according to CEAP classification, in 1 patient. Arterial disease was excluded by means of palpable distal arterial pulsations or ankle-brachial index. Patients complaints included pain, fatigue, and esthetic problems. Three patients had previously undergone stripping of the greater saphenous vein. Coexisting venous reflux in other sites and possible previous deep venous thrombosis is shown in Table I.

Preoperative duplex scanning was performed 1 day before the procedure, with all patients in a near-standing position, with either an Aloka 5500 scanner (Aloka Co Ltd, Tokyo, Japan) with 5 to 10 MHz transducer or ATL 5000 scanner (Advanced Technology Laboratories, Bothel, Wash) with 5 to 12 MHz linear array transducer. Insufficiency was defined when reflux times exceeded 0.3 seconds.[6-8] During duplex scanning the specific location of the perforating veins in relationship with different compartments was noted. A cross section of the four compartments of the leg is shown in Fig 1.

The operation is performed after administration of spinal anesthesia and with the patient supine. A short,

Table I. Coexisting venous reflux sites and previous deep venous thromboses

		Venous reflux				
	Previous deep	*Superficial*		*Deep*		
Patient	*thrombosis*	*GSV*	*LSV*	*Femoral*	*Popliteal*	*Tibial*
1	−	+	−	−	−	−
2	−	−	+	+	+	−
3	−	+	+	−	−	−
4	−	−	+	−	−	−
5	−	+	−	+	+	−
6	+	−	+	−	+	−
7	−	−	+	−	−	−
8	−	+	+	−	−	−
9	+	−	+	+	+	+
10	−	+	−	−	−	−
11	+	−	+	−	+	−
12	−	−	−	−	−	−
13	−	−	+	−	−	−

GSV, greater saphenous vein; *LSV,* lower saphenous vein.

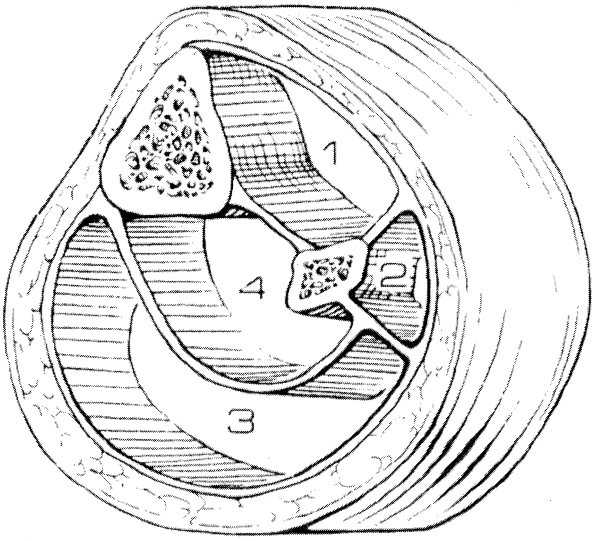

Fig 1. Cross section of four compartments of leg. *1,* Anterior tibial compartment; *2,* lateral peroneal compartment; *3,* superficial posterior compartment; *4,* deep posterior compartment.

transverse incision is made in the skin at the anterolateral side of the proximal third of the lower leg, and the subcuticular tissue is dissected. The crural fascia is exposed and incised over 2 cm, and the virtual subfascial space is opened with blunt dissection. A scope (Olympus, Tokyo, Japan), 18 cm in length and 12 mm in diameter, is inserted and pushed down in the subfascial space to the level of the lateral malleolus to separate the crural fascia from the musculature. This maneuver allows full examination of the subfascial area. Subfascial endoscopy is started in the anterior tibial compartment. With the leg flexed at the hip and knee, both sufficient and insufficient perforating veins are visualized and are ligated with hemoclips, and subsequently are dissected. During subfascial examination, sufficient perforating veins are not distinguishable from insufficient veins. Inframalleolar perforating veins were not treated, because they could not be reached with this technique. Next the septum intermusculare is transsected between the anterior tibial compartment and the lateral peroneal compartment. After dissection of all perforating veins, transsection of the septum intermusculare is continued between the lateral peroneal and superficial posterior compartments. Finally, after dissection of the perforating veins the scope is removed, the fascia is left open, the skin is sutured, and a compression bandage is applied. All patients were released the next day. Patients started with ambulant compressive bandaging therapy.

The first follow-up was 2 weeks after discharge. If healing of the ulceration was achieved, the ambulant compression bandage was removed and below-knee elastic stockings (class II) were applied. A control duplex scan was also obtained. Average time between operation and the postoperative duplex scan was 2 months (range, 1-8 months).

In three patients the lateral SEPS procedure was combined with a medial SEPS procedure. In another three patients the procedure was combined with ligation of the lesser saphenous vein. In one patient, both ligation of the lesser saphenous vein and a medial SEPS procedure was performed. In another patient, the procedure was combined with stripping of the greater saphenous vein. In the remaining five patients only a lateral SEPS procedure was performed.

RESULTS

With preoperative duplex scanning, 46 perforating veins were found (Fig 2). Twenty-three perforating veins were insufficient (mean, 1.8 per patient; range, 0-4 per patient). The distribution of perforating veins in the various compartments in the leg is roughly equal, with a slightly more proximal position of the perforating veins in the anterior tibial compartment in relation to the distal position of the perforating veins in the superficial posterior compartment. During the procedure, 37 perforating veins were dissected.

The postoperative control duplex scan in Fig 3 demonstrates persistent insufficient perforating veins. Postoperatively, the number of insufficient perforating veins was reduced from 23 to 9 (mean, 0.7 per patient; range, 0-3 per patient; $P = .02$, Wilcoxon test; Table II). Four were located in the proximal part of the peroneal compartment, and the remaining five insufficient perforating veins were located in the distal part of the superficial posterior compartment. Together with persistent insufficient perforating veins, 16 sufficient perforating veins were still present.

In one patient a first-degree wound infection developed, which was conservatively treated without antibiotic agents.

Mean follow-up was 53 months (range, 33-81 months). Complete ulcer healing was achieved in six patients within 6 months. Venous ulceration persisted in six

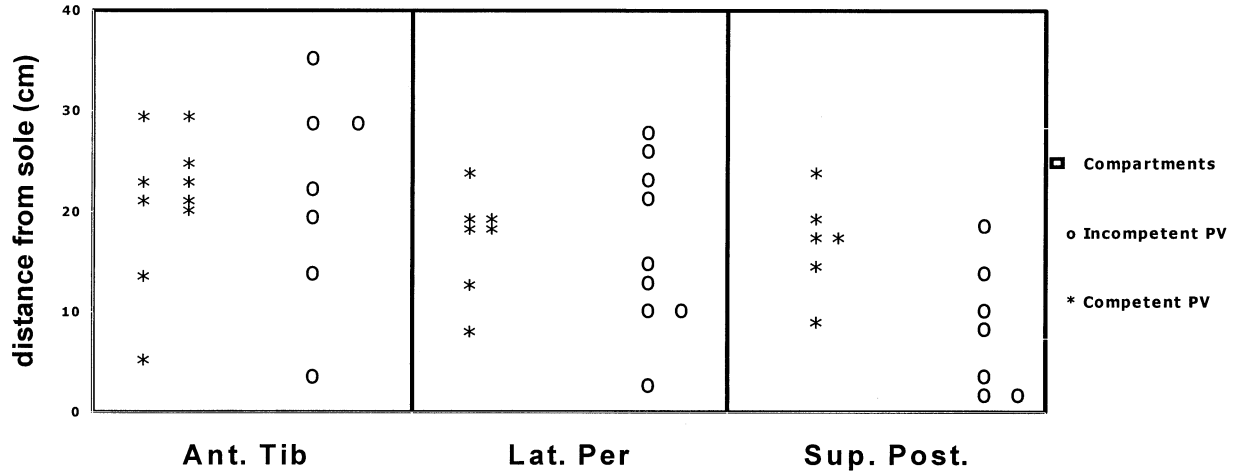

Fig 2. Preoperative duplex scanning results show distribution of both competent and incompetent perforating veins in anterior tibial, lateral peroneal, and superficial posterior compartments of lower leg.

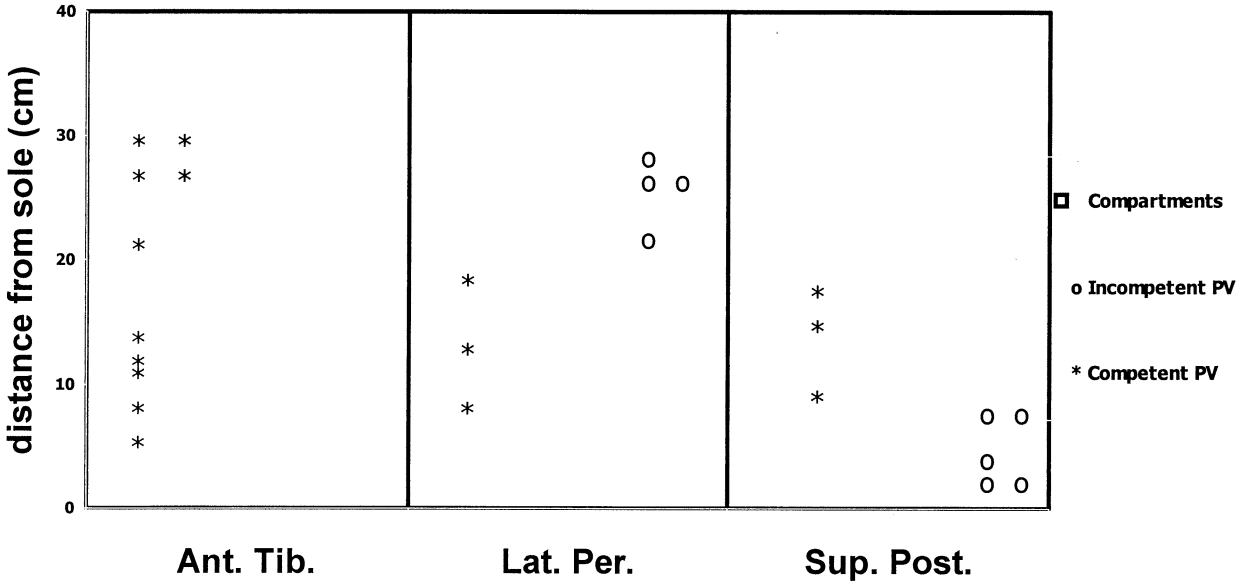

Fig 3. Postoperative duplex scanning results show persistent insufficient perforating veins in peroneal and superficial dorsal compartments of lower leg.

patients, three of whom had persistent insufficient perforating veins at postoperative duplex scanning (Table III). However, the association between persistent insufficient perforating veins and healing of ulcer in this small series was not significant ($P = .18$). Recurrent ulcer was noted in three patients, after 17, 29, and 60 months, respectively. In one of these patients, repeat SEPS again resulted in complete healing within 6 months. Another patient underwent open ligation of incompetent perforating veins, which has not resulted in healing of the ulcer. The patient without ulcer had persistent complaints of varicosities. One patient was lost to follow-up.

DISCUSSION

Until now, no studies have been conducted to analyze the effect of endoscopic ligation of insufficient perforating veins on the lateral side of the lower leg in patients with venous ulcer on that side.

The results of the procedure as performed are poor. There are various explanations for these bad results. As shown in Fig 3, insufficient perforating veins persisted postoperatively. Was this caused by inappropriate technique? If we look at the exact location of the persistent insufficient perforating veins, it is clear that most are lo-

Table II. Number of PVs found at preoperative and postoperative duplex scanning, and number of PVs ligated at operation

	Preoperative duplex scan		*PVs ligated during operation*	*Postoperative duplex scan*	
Patient	*Insufficient PV*	*Sufficient PV*		*Sufficient PV*	*Insufficient PV*
1	2	0	5	0	0
2	1	3	2	0	0
3	2	0	3	0	0
4*	4	0	7	3	0
5	0	0	1	0	0
6	0	3	?	1	0
7	0	1	3	0	0
8	4	5	1	6	3
9	2	1	2	1	3
10	1	2	2	1	0
11	3	0	3	0	3
12	3	7	7	4	0
13	1	1	1	0	0
Total	23	23	37	16	9

PV, Perforating vein.
*No release.

Table III. Relationship between persistent insufficient PVs found at postoperative duplex scanning and persistent ulceration*

	PVs present	*PVs obliterated*
Ulcer healed	0	6
Persistent ulceration	3	3

*$P = .18$, Fisher exact test.

cated in the superficial posterior compartment. This compartment is difficult to reach from the anterior tibial compartment with the Olympus scope, because of the presence of the fibula. Furthermore, several perforating veins were located in the inframalleolar compartment. With the available technique and materials, these veins cannot be reached. At present there is no solution to this problem. To avert problems with the fibula, it may have been more appropriate to begin the lateral SEPS in the lateral peroneal or superficial posterior compartment, rather than the anterior tibial compartment.

Together with persistent insufficient perforating veins, persistent sufficient perforating veins were present postoperatively, probably because of the presence of paratibial perforating veins. These are difficult to see and to reach with the Olympus scope, and are subsequently missed during operation. An additional factor contributing to these results could be increased experience in duplex scanning by our employees at the Vascular Research Laboratory, resulting in improved ability to locate more perforating veins than previously. Results of preoperative and postoperative duplex scanning and the number of perforating veins ligated during the operation are presented in Table II.

The presence of persistent insufficient perforating veins postoperatively indicates insufficient surgical technique. As shown in Table III, persistent insufficient perforating veins were present in patients with persistent venous ulcerations, which contributed to our belief that insufficient perforating veins have a role in the genesis of venous ulcerations. The calculated P value, however, was not significant in this small series. In contrast to the presence of persistent insufficient perforating veins in patients with persistent venous ulcerations, three patients had persistent ulcers despite the absence of incompetent perforating veins. Thus there must be other mechanisms involved in the pathophysiology of lateral venous ulcerations. It is striking to see that in all three patients with persistent venous ulcers without concomitant incompetent perforating veins there was coexisting venous reflux at the site of the saphenopopliteal junction. This contributed to our belief that saphenopopliteal junction reflux has a role in the genesis of lateral leg ulcers. Satisfactory results in lateral venous ulcer healing after ligation and division of the saphenopopliteal junction were described by Bass et al.[9]

The results of this study suggest the need to improve the surgical technique to obliterate as many perforating veins as possible and improve clinical results. This requires information about the exact location of perforating veins in the lateral aspect of the lower leg. In this series the exact location of the perforating veins was not always marked on the skin during preoperative duplex scanning; thus it was difficult to determine the exact location during surgery. We advise marking the location of all perforating veins on the skin preoperatively.

An important factor contributing to the success rate of SEPS is anatomic knowledge concerning exact location of the perforating veins. Although a considerable number of studies have been performed on the medial aspect of the lower leg, no anatomic data are available regarding location of perforating veins in the lateral aspect of the lower leg. This poses a problem in determining possible technical improvements. Therefore, a study is being conducted to obtain this anatomic information. With adequate anatomic information and preoperative marking of the location of perforating veins on the skin, the endoscopic procedure may be improved significantly, with a higher rate of healing and lower rate of recurrent disease in patients with venous ulceration on the lateral side of the lower leg.

CONCLUSIONS

There is a considerable difference between the results of SEPS performed on the medial and lateral sides of the lower leg. On the medial side, the procedure is valuable in treatment of venous ulceration. In this small series SEPS performed on the lateral side of the lower leg did not contribute to ulcer healing or recurrence. A considerable number of perforating veins are missed during operation, giving rise to persistent insufficient perforating veins postoperatively. The poor results of this study emphasize the need for adequate anatomic information to improve surgical outcome.

REFERENCES

1. Bergan JJ, Murray J, Grason K. Subfascial endoscopic perforator vein surgery: a preliminary report. Ann Vasc Surg 1996;10:211-9.
2. Pierik EGJM, Wittens CHA, van Urk H. Subfascial endoscopic ligation in the treatment of incompetent perforating veins. Eur J Vasc Endovasc Surg 1995;9:38-41.
3. Wittens CHA, Bollen EC, Kool DR, van Urk H, Mul T, van Houtte HJ. Good results of subfascial endoscopy as treatment of communicating vein insufficiency. Ned Tijdschr Geneeskd 1993;137:1200-4.
4. Pierik EGJM, van Urk H, Wittens CHA. Endoscopic ligation of perforating veins using a mediastinoscope. Surg Laparosc Endosc 1997;7:25-8.
5. Mozes G, Gloviczki P. Surgical anatomy for endoscopic subfascial division of perforating veins. J Vasc Surg 1996;24:800-8.
6. Pierik EGJM, Toonder IM, van Urk H, Wittens CHA. Validation of duplex ultrasonography in detecting competent and incompetent perforating veins in patients with venous ulceration of the lower leg. J Vasc Surg 1997;26:49-52.
7. Gloviczki P, Bergan JJ. Atlas of endoscopic perforator vein surgery. New York, NY: Springer Verlag.
8. van Ramshorst B. Duplex scanning in the diagnosis and follow-up of deep vein thrombosis. [thesis]. Utrecht, The Netherlands: University of Utrecht; 1992.
9. Bass A, Chayen D, Weinmann EE, Ziss M. Lateral venous ulcer and short saphenous vein insufficiency. J Vasc Surg 1997;25:654-7.

Submitted Jan 7, 2003; accepted Feb 28, 2003.